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## **Cytotoxic effects of fresh aloe vera gel mediated silver nano composite: An In vitro study**

**Dr. Soya Alfred Xavier**

Post Graduate, Department of Oral and Maxillofacial Surgery, Saveetha Dental College, Saveetha Institute of Medical and Technical Science, Saveetha University Chennai, India 600077

**Dr. Abdul Wahab**

Professor, Department of Oral and Maxillofacial Surgery Saveetha Dental College Saveetha Institute of Medical and Technical Science, Saveetha University, Chennai, India- 600077

**Dr S Rajeshkumar**

Associate Professor, Nanobiomedicine Lab, Saveetha Dental College, Saveetha Institute of Medical and Technical Science, Saveetha University Chennai, India 600077

**Abstract**---Aim: To evaluate the cytotoxic effect if fresh aloe vera gel mediated silver nano composites Materials And Methods: A 10 gram portion of thoroughly washed fresh cut aloe vera was used in this study. 10 gram of the pulp of the leaf was extracted and was used for the experiments. 10 gram of silver nitrate powder was dissolved in 40 ml of distilled water. To this 40 ml of distilled water the fresh aloe vera extract was added. The solution was placed in the shaker and an observation was made for every two hours for analysing the synthesis of nanoparticles under UV visual spectroscopy . This was followed by the placement of the solution onto the magnetic stirrer for the formation of the nanoparticle .The mixture is then centrifuged at 8000 rpm for 10 minutes and then the nano particles were collected .The resulting solution was further characterised by the TEM measurements. The cytotoxicity was tested by seeding brine shrimps into a 6 well plate. Various concentration of silver nitrate solution was added on the mixture. The brine shrimp cells were then treated with different concentrations of AgNPs (10, 20, 50, 100, 250, and 500  $\mu\text{mol mL}^{-1}$ ) respectively with 100  $\mu\text{L}$  per well and allowed for 36 hrs of incubation . Results: The TEM images reveal that the nano particle hybrid are spherical in shape. It could have an average diameter of 25 nm. It could be well dispersed in water and it can stay stable for a

period of 3 months. The silver nanoparticle solution didnot show any cytotoxic effects at the concentrations of 5 ul , 20 ul and 80 ul. Conclusion: Aloe Vera silver nanoparticle is an emerging technology which can revolutionize various fields in biomedicine

**Keywords**---silver nano particle, aloe vera, nano medicine, silver nitrate, nano technology

## **Introduction**

Due to their potential application in the vast number of areas , the emergence of nanoparticles has become a current trend in the scientific field. They have been extensively exploited and targeted for use in biomedical areas, such as targeted drug delivery. Imaging , sensing and antimicrobial (Park et al. 2009). Silver is the most common metal which is used for the manufacturing of silver nanoparticles. Silver nanoparticles are widely known for their antimicrobial property. These silver Nano particles can be successfully synthesized by traditionally chemical and physical methods (Uludağ and Tothill 2010) . However, these methods strongly depend on severe reaction conditions such as aggressive agents like sodium borohydride and harmful solvent system to environment and ecology, higher temperature and higher pressure. Hence, in order to be environmental friendly an acceptable solvent system a reducing and capping agents are necessary (Mukherjee et al. 2001). Aloe Vera also known as the” wand of the heaven “, is a plant commonly known for its antibacterial properties. The pulp of this plant has been used for medical, therapeutic as well as cosmetic purposes. Certain invitro studies of aloe vera on animals have proven that this plant has anti inflammatory , anti- bacterial and anti-arthritic activity (Chandran et al. 2006). The aim of this study was to create an environmental friendly nano particles which is of low cost and has significant cytotoxicity effect of brine shrimps.

Previously our team has a rich experience in working on various research projects across multiple disciplines (Govindaraju and Gurunathan 2017; A. Christabel et al. 2016; Soh and Narayanan 2013; Mehta et al. 2019; Ezhilarasan, Apoorva, and Ashok Vardhan 2019; Campeau et al. 2014; Kumar and S 2016; S. L. Christabel 2015; Kumar and Rahman 2017; Sridharan, Ramani, and Patankar 2017; Ramesh et al. 2016; Thamaraiselvan et al. 2015; Thangaraj et al. 2016; Ponnulakshmi et al. 2019; “Fluoride, Fluoridated Toothpaste Efficacy and Its Safety in Children - Review” 2018) Now the growing trend in this area motivated us to pursue this project.

## **Materials and Methods**

A 10 gram portion of thoroughly washed fresh cut aloe vera was used in this study. 10 gram of the pulp of the leaf was extracted and was used for various experiments (Fig 1). 10 gram of silver nitrate powder was dissolved 40 ml of distilled water. To this 40 ml of distilled water the fresh aloe vera extract was added. The solution was placed in the shaker and an observation was made for every two hours for analysing the synthesis of nanoparticles under UV visual

spectroscopy ( Fig 2). This was followed by the placement of the solution on to the magnetic stirrer for the formation of the nanoparticle (Fig 3). The mixture is then centrifuged at 8000 rpm for 10 minutes and then the nano particles were collected (Fig 4). The resulting solution was further characterised by the TEM measurements.

The cytotoxicity was tested by seeding brine shrimps into a 10 well plate ( Fig 5). Various concentration of silver nitrate solution was added on the mixture. The brine shrimp cells were then treated with different concentrations of AgNPs 10, 20, 50, 100, 250, and 500  $\mu\text{mol mL}^{-1}$  respectively with 100  $\mu\text{L}$  per well and allowed for 36hrs of incubation.

## Results

The TEM images reveal that the nano particle hybrid are spherical in shape ( Fig 6) . It could have an average diameter of 25 nm. It could be well dispersed in water and it can stay stable for a period of 3 months. The silver nanoparticle solution did not show any cytotoxic effects at the concentrations of 5  $\mu\text{L}$  , 20  $\mu\text{L}$  and 80  $\mu\text{L}$ .



Fig 1: Aloe vera gel

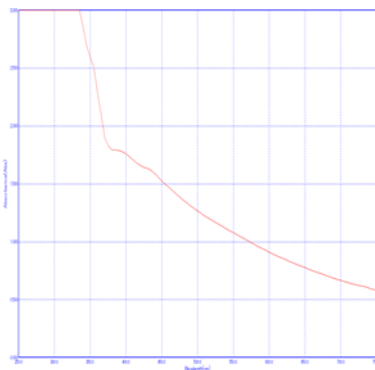


Fig 2: UV-vis spectroscopic analysis of silver nanoparticles

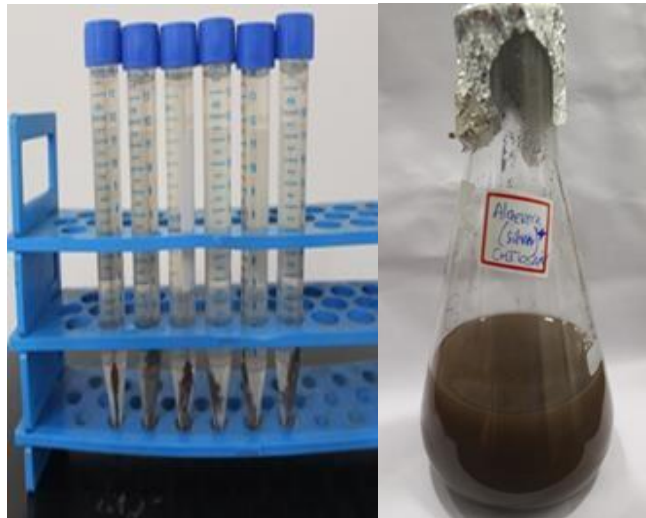


Fig 3 : Aloe vera based silver nanoparticles

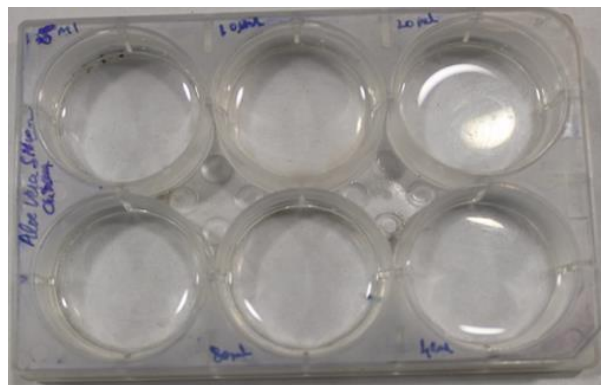


Fig 4 : Cytotoxic effect

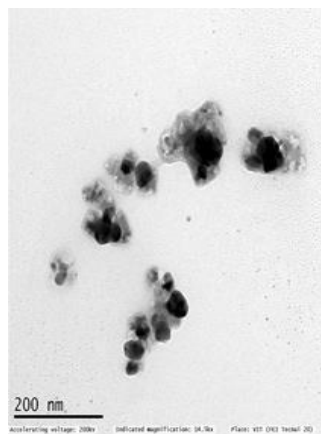


Fig 5 : Transmission electron microscopic image of nanoparticles

## Discussion

From centuries ago silver nano particles were being used to treat a number of medical conditions. Their antibacterial property is known to many scientists. The current technology also enables this antibacterial property to be channelized in the required direction causing no harm. It is believed that the release of silver ions from these particles is responsible for antibacterial property. Their mechanism of action is rather complex. It is stated that the release of silver ions along with the increasing membrane permeability, loss of the proton motive force, inducing de-energization of the cells and efflux of phosphate, leakage of cellular content, and disruption DNA replication. These factors together contribute for the cytotoxic property of aloe vera (Mukherjee et al. 2001).

Certain constituents present in aloe vera including lignin, hemicellulose and in particular pectin present in this plant can help in the reduction of silver ions to produce aloe vera silver nanoparticle. There are studies which have speculated that some active biological molecules such as benzoquinones in plant extracts might act as the reduction agents for formation of the nanoparticles (Mukherjee et al. 2001). The aloe vera silver nano particle molecules can act as a carrier vehicle and can help in the transportation of the aloe vera molecule into the cells of the brine shrimp, to cause certain genotoxic action that can lead to the inactivation of the organisms (Stoimenov et al. 2002). The detailed mechanism of action of this nano particle should be further studied by undertaking various in vitro studies. Majority of the studies in the literature explain only about the antibacterial property. More number of studies should be conducted to evaluate the cytotoxic effect of this nanoparticle.

## Conclusion

Aloe vera silver nanoparticle is an emerging technology which can revolutionize various fields in biomedicine. These nano particles which are created are cost effective, give high yields and are environmental friendly. The resulting Aloe vera nano composite showed a synergistic cytotoxic effect which indirectly indicates its significant role in future biomedical application.

## Contribution of Author

The corresponding author has conducted the study and has written the manuscript. The co author has corrected the manuscript.

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